AMP Place, Brisbane compressor retrofit

Retrofitted Chiller

Original chiller prior to retrofit

When one of three chillers failed at Brisbane's AMP Place building last year, a unique retrofit was conducted which not only had the building's HVAC system up and running in less than three months, but also resulted in significant energy savings. **Sean McGowan reports**

In August 2004, Ford Consulting was engaged by AMP to provide an options report for its #2 chiller. Just as this occurred, the building's lead #1 1850kWr chiller suffered a catastrophic compressor failure, resulting in the loss of 40% of plant capacity.

With Brisbane's summer fast approaching, focus quickly changed to the problem at hand.

"To say the situation was urgent is an understatement," says Trevor Ford of Ford Consulting, the consulting engineer on the project.

A single compressor, single stage centrifugal chiller, the failed unit was an original R12 machine that had been installed in 1976 and retrofitted with R134a in 2000, resulting in a 15% loss of capacity. Having previously failed and been rebuilt twice, Ford strongly recommended the building owner either retrofit or replace the chiller rather than attempt to rebuild it again.

Eddy current testing showed the vessels to be in good condition, and after the possibility of lifting a new chiller onto the roof of the building was ruled out a decision to retrofit with multiple compressors was made.

"To say the situation was urgent is an understatement"

"After assessing various options and talking to manufacturers and suppliers, we decided the only option with any real chance of regaining additional cooling capacity for summer was to retrofit the chiller with Turbocor compressors," says Ford.

The new design meant everything on the machine was removed, including the control panel, oil tank, oil pump, oil heater and oil cooler. Additionally, all

pipework was removed and the chiller vessels stripped back to bare metal before being corrosion treated.

The new design by Wayne Van Aken, Queensland state manager for Airmaster Australia and Noel Courtney, Airmaster Australia managing director, included a rack system for the compressors, a new direct digital control system with a touch screen graphical interface and electronic expansion valve evaporator control.

"The new compressors have their own inbuilt soft starters therefore the original starting equipment was made redundant," explains Van Aken. "The existing chiller switchboard was completely stripped out and the main starting contactors removed and reconfigured with new bus bars."

Turbocor compressors were chosen for the project, largely due to their technologically advanced and lightweight design which allowed them to be air freighted to Australia, transported to the plant room via the existing goods lift and installed within the short timeframe.

"We were impressed by the claimed energy efficiency and simplicity of the compressors - no oil, gears or conventional bearings", says Ford. "And utilising multiple compressors meant that in the unlikely event of a future problem the impact on overall plant capacity would be minimal".

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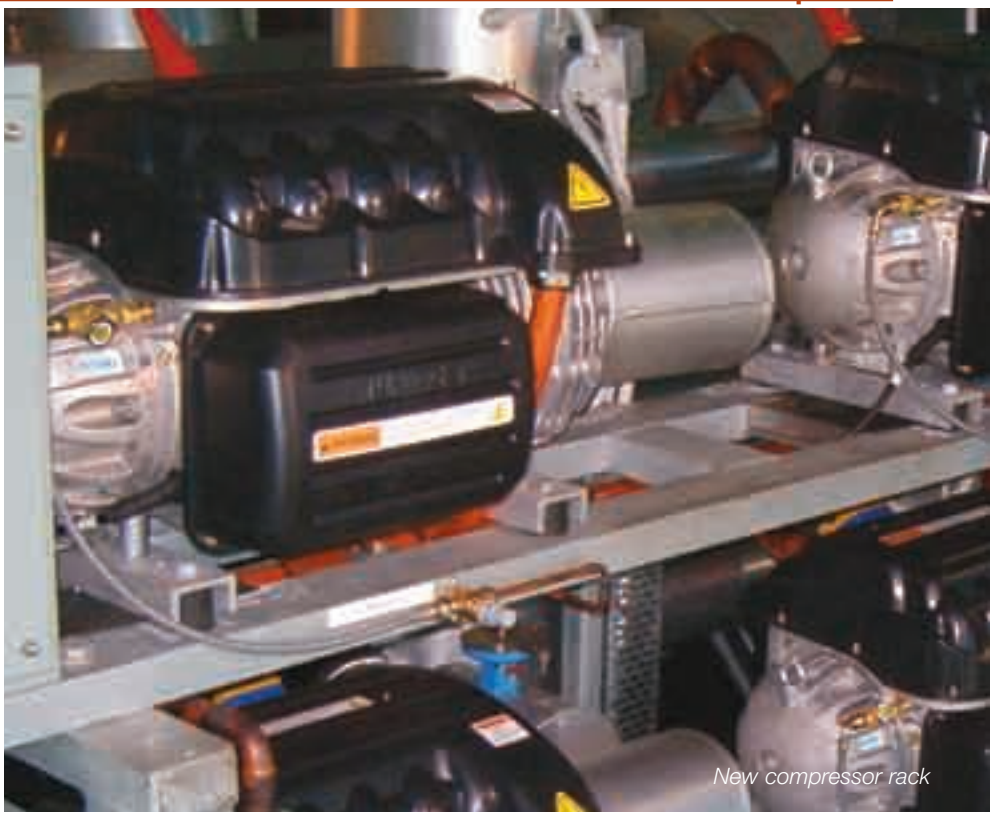
No oil in the refrigeration system means a gain in heat exchanger efficiencies and a general increase in chiller performance. Along with inbuilt soft starters and variable frequency drives, the Turbocor compressors also have an inrush current at each compressor start of less than 2 amps compared to an inrush current in excess of 2000 amps on the original compressor.

"The variable speed of the compressor and use of electronic expansion valves means chiller capacity is matched exactly to the building and system load requirements," says Van Aken.



New compressor rack

"The compressor is designed specifically to operate on refrigerant 134a, which is a zero ozone depleting refrigerant commercially available and addresses the issue of refrigerant upgrade which is needed on many sites."

The minimum load point for the compressors is 60kWr, and they provide a low noise signature of less than 75dBA, meaning the retrofitted chiller is now quieter than the chilled and condenser water pumps operating in the same plant room.

"From order to the chiller first running took only two months to the day. In our experience this is a remarkable achievement for a chiller of this size and a credit to the Airmaster team," says Ford.

Operational and contributing to the building chiller plant capacity from the 21st of December 2004, the project has been hailed a complete success, with the chiller operating faultlessly since practical completion.

"When compared to the original Westinghouse/Email chiller the difference is stark. Full load current has reduced from 720 amps to 595 amps with capacity at 1830kWr, just 20kWr from the original R12 design. The on board data acquisition system has also recorded chiller output in excess of 1900kWr," adds Van Aken.

The original design full load COP of 3.87 was modeled to increase to a COP of 4.73 using the Turbocor compressor - the actual recorded COP finished at 4.92.

"Considering we are using 29-year-old vessels the result is entirely satisfactory"

Site observations have shown a 20% energy saving at full load and a 55% energy saving at 50% of the full load capacity when compared to the original chiller, meaning the retrofit was not only able to restore 15% of lost capacity, but also significantly reduce the buildings energy costs.

"Considering we are using 29-year-old vessels and associated heat transfer technology, in our opinion the result is entirely satisfactory," says Ford.

The retrofit of a second AMP Place chiller is now underway. ■

Contacts

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